How Dry (and Warm) I Am:

Summer 2015 King County Drought Status Reporting

USEPA/Flickr

Curtis DeGasperi
King County DNRP, WLRD
2015 Science Seminar
November 5, 2015

The Seattle Times

Snowpack drought has salmon dying in overheated rivers

Originally published July 25, 2015 at 5:42 pm | *Updated July 28, 2015 at 11:18 am*

May 15, 2015

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Washington Governor Declares Statewide 'Snowpack Drought'

By ANNA KING • MAY 15, 2015

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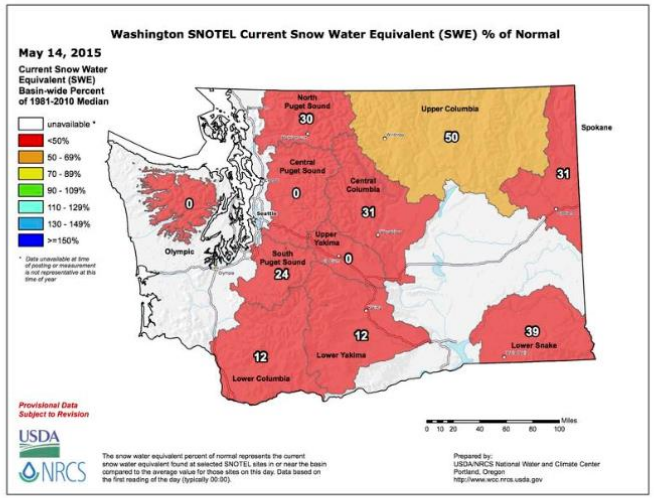

The Washington Department of Ecology released a USDA map to show snowpack levels in advance of Gov. Jay Inslee's declaration of a "snowpack drought."

USDA


Dammit Jim, I'm a Hydrologist
not a miracle worker!

WaterWatch

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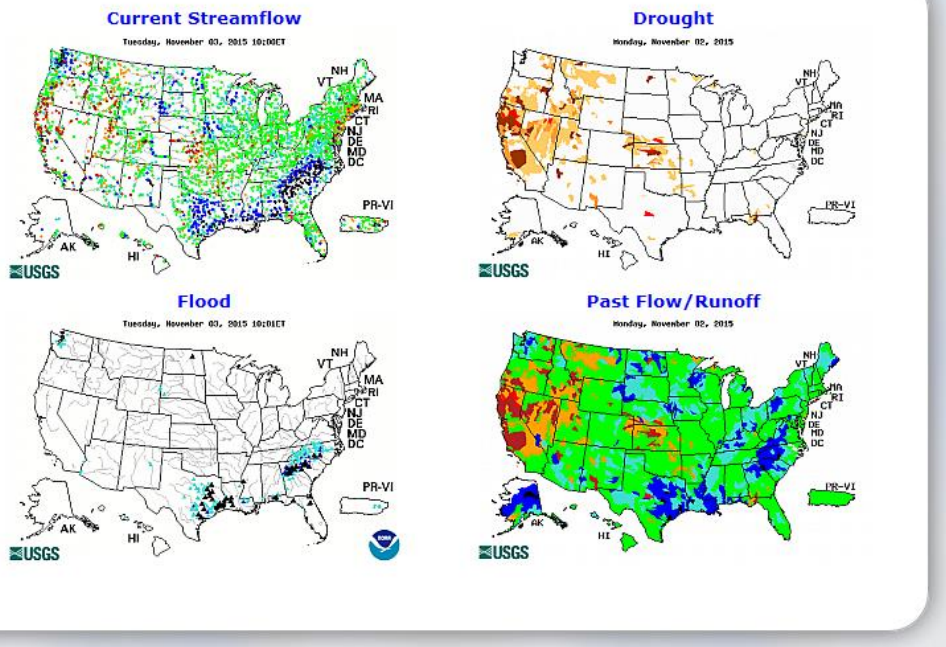

WaterQualityWatch -- Continuous Real-Time Water Quality of Surface Water in the United States

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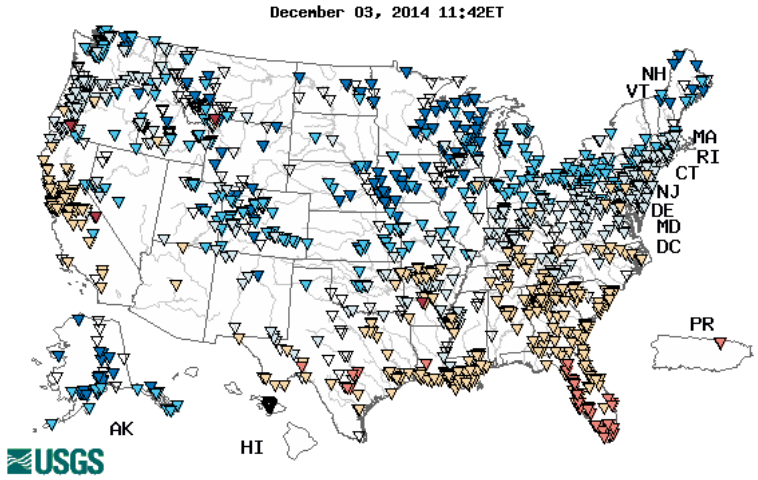
Real-Time Water Temperature, in °C



Explanation							
<1	1-4.9	5-9.9	10-19.9	20-29.9	30-35	>35	No Data *

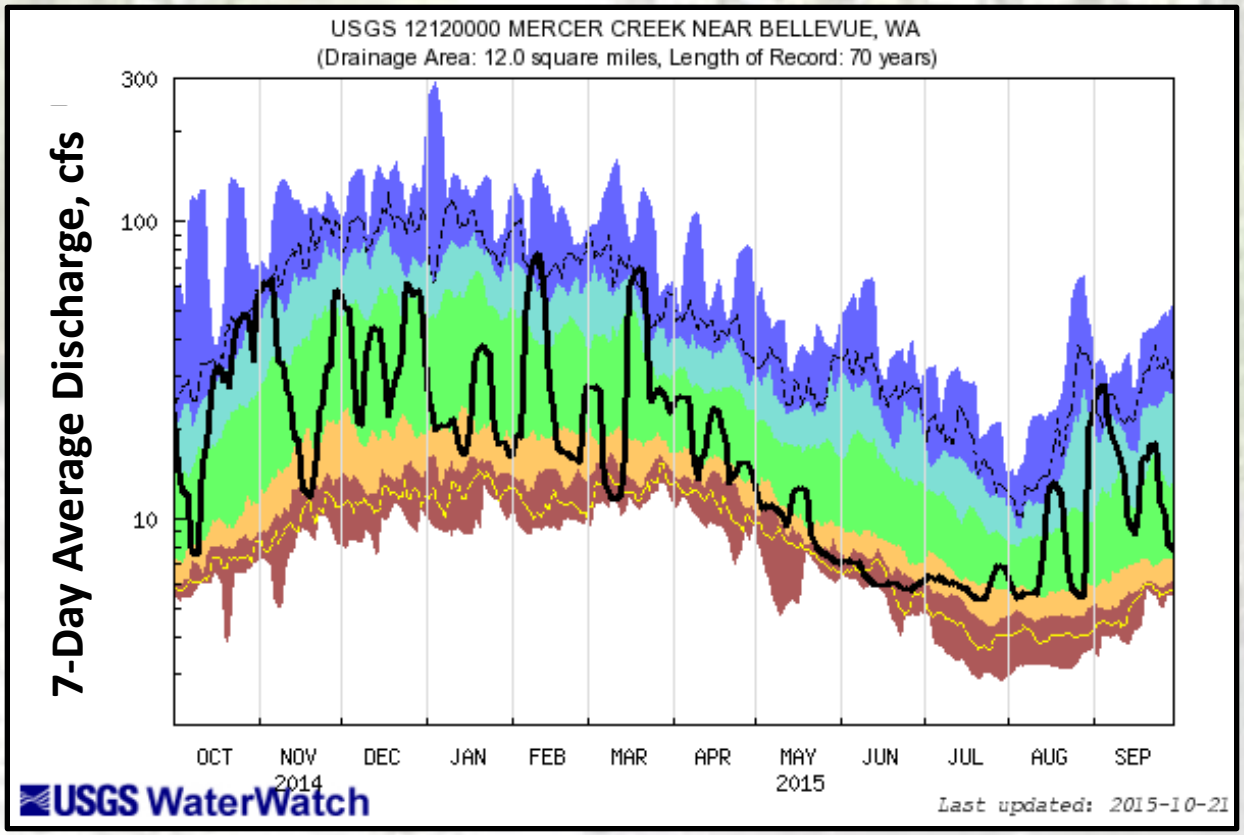
Temp | Cond | pH | D.O. | Turb | Nitrate | Disch | Surrogates

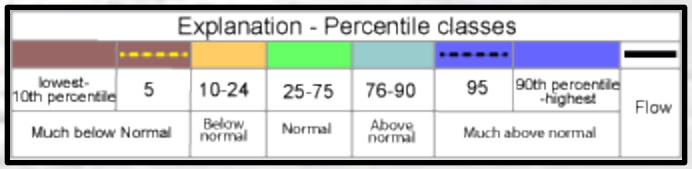
* Site operated on a seasonal basis or currently is not operating.
No values are available for the last 6 hours.

The "Real-time" map tracks short-term changes (over several hours) of water quality. Although the general appearance of the map changes very little from one hour to the next, individual sites may change rapidly in response to major rain events or to reservoir releases. The data used to produce this map are provisional.

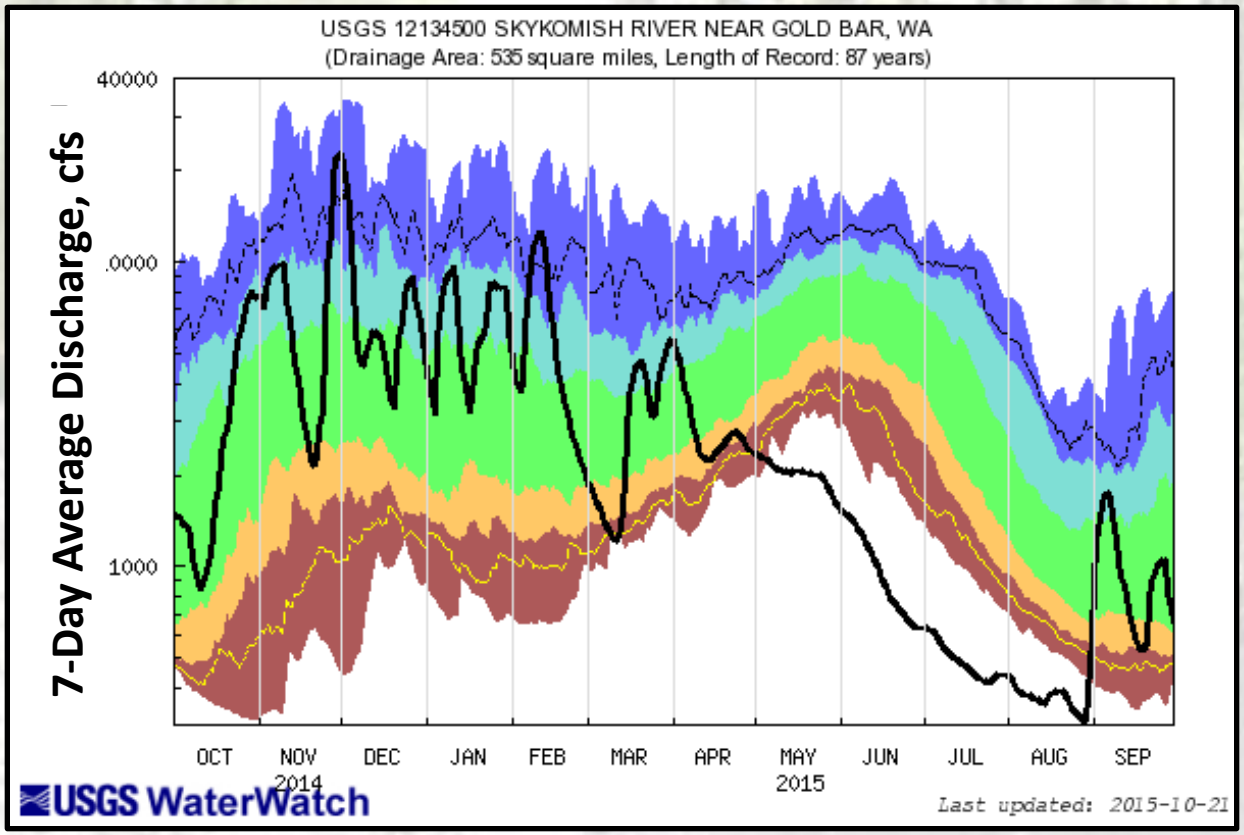
Animate national map by current Month, or last 12 months

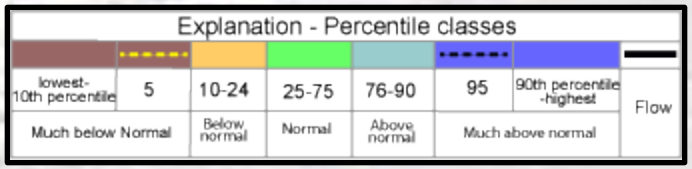
USGS Mercer Creek near Bellevue



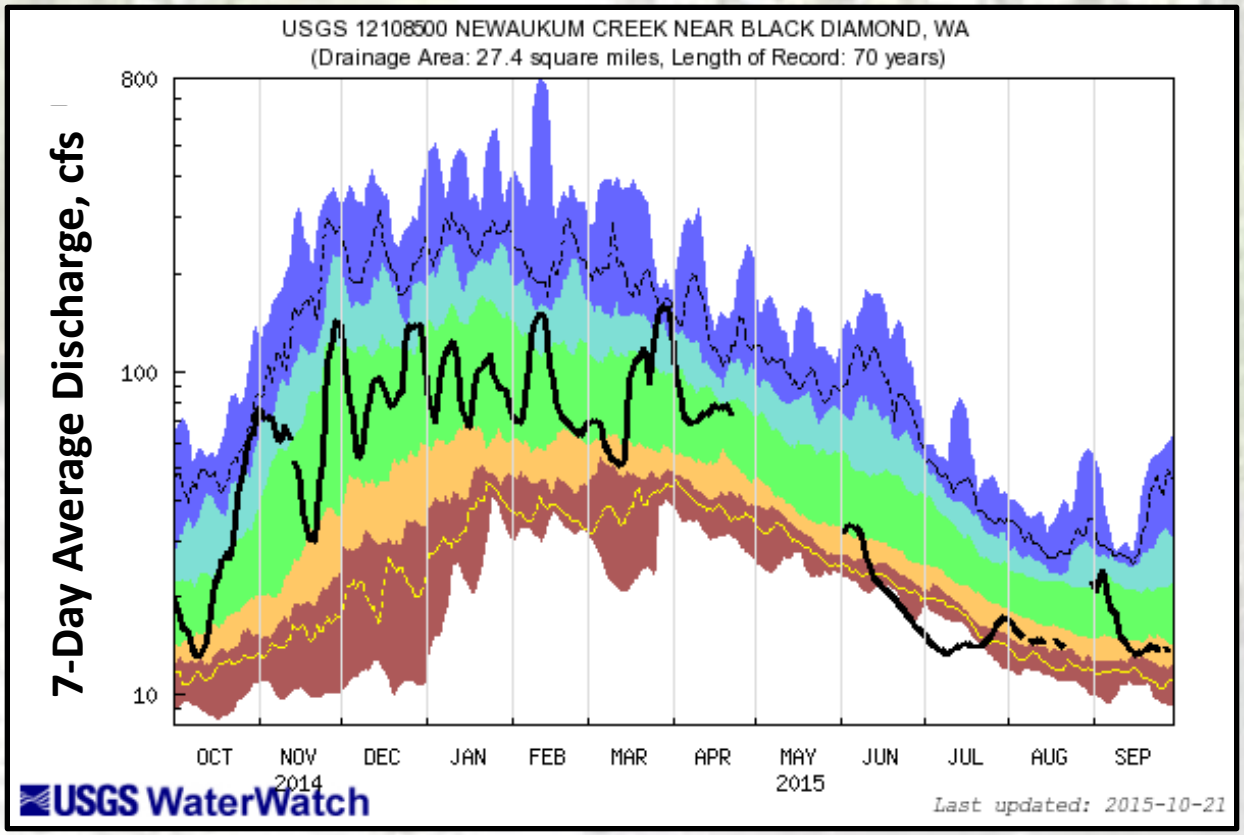


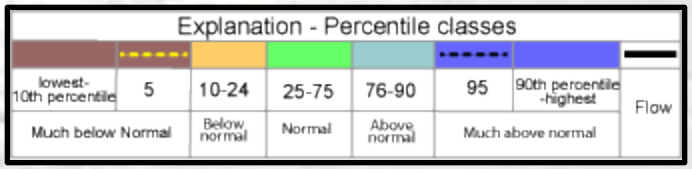
USGS Skykomish River near Gold Bar



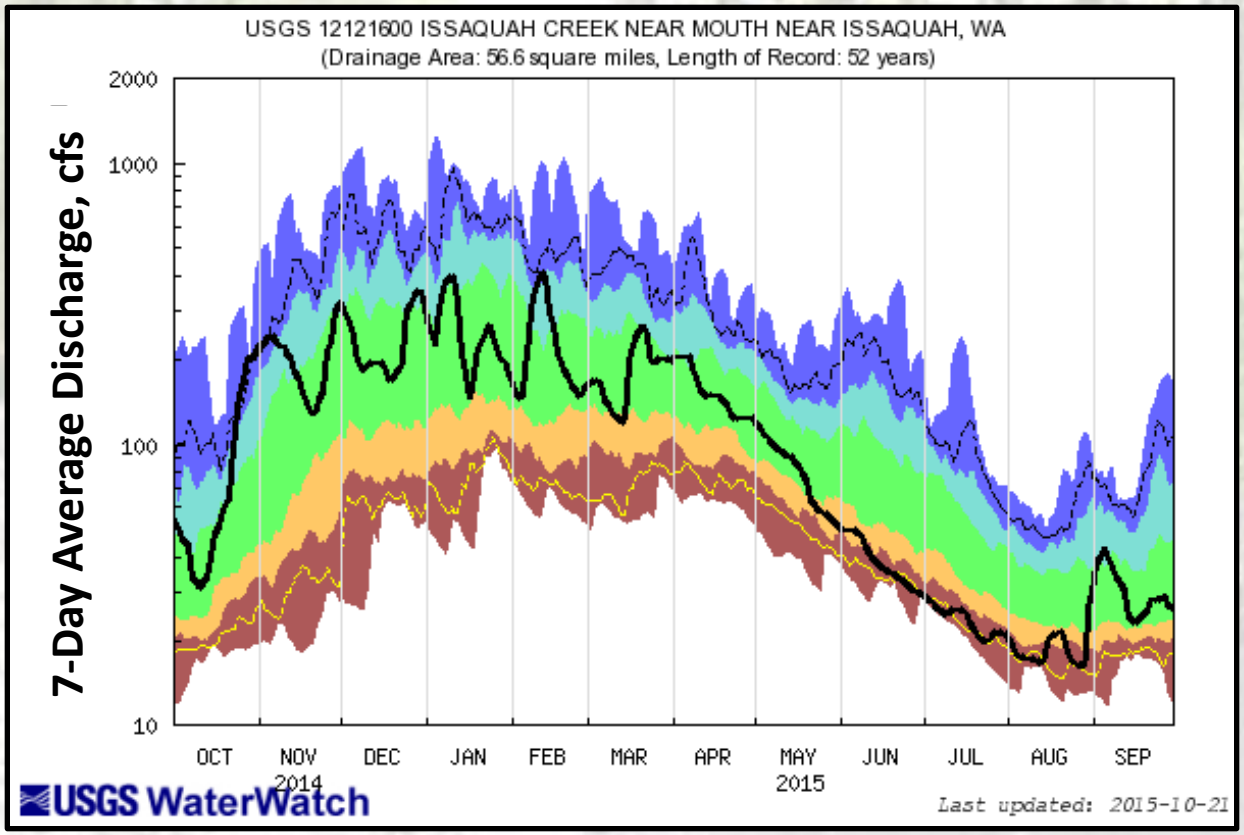


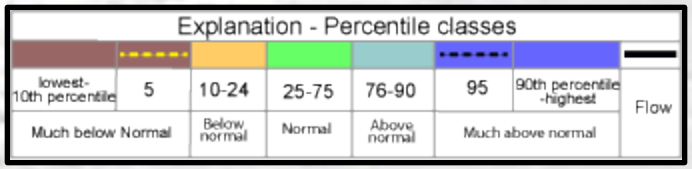
USGS Newaukum Creek near Black Diamond





USGS Issaquah Creek near Issaquah





//kc.kingcounty.lcl/dnrp/WLRD/Users/UsersSTS1/degaspec/R/2015app - RStudio

File Edit Code View Plots Session Build Debug Tools Help

Go to file/function

2015app — degaspec

fill.R × flow_kc.R × temperature.R × temperature_kc.R × flow.R ×

Source on Save Run Source

```
 9  require(readxl)
10
11  tblchk <- whatNWISdata(df$staid, service = "dv", parameterCd = "00060", statCd
12  write.table(tblchk,"usgs_qdv_list.csv",sep = ",")
13
14  rm(list=ls())
15
16  #week <- 26  #change (add 1)
17  # week <- 26
18  day <- Sys.Date()-1 #sets to previous Sunday...assumes that today is the follow
19  week <-isoweek(day)
20  week
21  #week <- 28
22
23  #df <- read_excel('//kc.kingcounty.lcl/dnrp/WLRD/Users/UsersSTS1/degaspec/R/201
24  df <- read_excel('P:/millerand/Temp and Flow Status 2015 (CURTIS PUT IT HERE)/2
25  df <- subset(df,is.na(df$Remove)==T)
26
27
```

21:2 (Top Level) R Script

Environment History

Import Dataset List

Global Environment

vals	20 obs. of 3 variables
weekvals	140 obs. of 9 variables
xLU	7 obs. of 2 variables
Values	
a	15L
bins2	int [1:20] 1 6 4 4 4 4 3 3 4 7 ...
channel	Class 'RODBC' atomic [1:1] 4
col1	num [1:20] 1996 1997 1998 1999 2000 ...
day	2015-07-12
f_out	"P:/millerand/Temp and Flow Status 2015 (CURT...
f_out2	"P:/millerand/Temp and Flow Status 2015 (CURT...
lstas	15L
quants	Named num [1:8] 1.49 1.62 1.64 1.81 2.43 ...
week	28

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Zoom Export

Console P:/millerand/Temp and Flow Status 2015 (CURTIS PUT IT HERE)/2015app/

```
+ }
[1] "Processsing...1...Bear Creek @ Union Hill RD 02a"
[1] "Processsing...2...Laughing Jacobs Creek at E Lake Sammamish Pkwy 15c"
[1] "Processsing...3...Juanita Creek at Mouth 27a"
[1] "Processsing...4...Lyon Creek near Mouth in Lake Forest Park 34a"
[1] "Processsing...5...McAleer @ Mouth 35c"
[1] "Processsing...6...Sammamish River at NE 116th ST, USGS gage 12125200 data before
 2005 51T"
[1] "Processsing...7...Thornton Creek near Mouth, USGS 1212800 data before 2013 58A"
[1] "Processsing...8...Covington Creek near Mouth,  Soos CR Watershed 09a"
[1] "Processsing...9...Des Moines Creek below SR 509, Des Moines (near mouth) 11d"
[1] "Processsing...10...Des Moines Tributary 0377 at Tyee Weir 11f"
[1] "Processsing...11...Jenkins Creek near Mouth  -  Soos Creek Watershed 26a"
[1] "Processsing...12...Judd Creek, Vashon Island 28a"
[1] "Processsing...13...Crisp Creek at Green River RD 40d"
[1] "Processsing...14...Soosette Creek Above SR 18 54h"
[1] "Processsing...15...Little Soos  Creek at   SE 272nd 54i"
>
>   write.csv(dataout, file = "P:/millerand/Temp and Flow Status 2015 (CURTIS PUT IT
HERE)/2015app/kc_flow.csv", row.names = FALSE)
> write.csv(dataout2, file = "P:/millerand/Temp and Flow Status 2015 (CURTIS PUT IT H
ERE)/2015app/kc_flow_summary.csv", row.names = FALSE)
> f_out <- paste('P:/millerand/Temp and Flow Status 2015 (CURTIS PUT IT HERE)/2015app
/','kc_flow_week_',toString(week),'.csv', sep = "")
> f_out2 <-paste('P:/millerand/Temp and Flow Status 2015 (CURTIS PUT IT HERE)/2015app
/','kc_flow_summary_week_',toString(week),'.csv', sep = "")
> write.csv(dataout, file = f_out, row.names = FALSE)
> write.csv(dataout2, file = f_out2, row.names = FALSE)
> day <-as.Date("2015-07-12") # set to previous Sunday
> week <-isoweek(day)
> week
[1] 28
>
```

Status of King County river and stream flows and temperatures (Sep 14-Sep 20) - Message (HTML)

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From: DeGasperi, Curtis
To: DeGasperi, Curtis
Cc: Simmonds, Jim
Subject: Status of King County river and stream flows and temperatures (Sep 14-Sep 20)
Sent: Tue 9/22/2015 1:28 PM

Message | KC Flow and Temp Summary Sep 14 to Sep 20.docx (2 MB) | Flow_and_Temp_Sep 14 to Sep 20_summary.xlsx (27 KB)

KING COUNTY RIVER AND CREEK FLOW AND TEMPERATURE SUMMARY FOR WEEK OF 9/14 - 9/20

Below is a weekly summary of flow and temperature in King County rivers and creeks for the week of September 14th to September 20th. This review looks at King County, USGS and USACOE sites with real-time data delivery and 15 years of data, so we can assess weekly flows and temperatures relative to historical conditions.

Note that we are discontinuing these weekly email updates for now. We would love to hear your feedback – what you liked, what you wanted but didn't see, etc. You can send your feedback to Curtis DeGasperi and Jim Simmonds using reply all to this email.

HEADLINES FROM THE WEEK

As we transition from an extremely unusual warm and dry spring and summer to hints of cooler and wetter weather to come, attention is turning to the discussion of the El Niño forecast. One of the strongest El Niños in decades is developing and is expected to result in warmer temperatures and slightly lower snowpack than normal in the mountains.
http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/lanina/enso_evolution-status-fcsts-web.pdf (in particular see Slide 31)

Some other El Niño-related news, a recent study published in Nature Geoscience suggests that the British Columbia Coast could experience higher tides, flooding and erosion in low-lying coastal areas in response to the coming "monster" El Niño according to one of the study's authors.

News story here: http://www.theglobeandmail.com/news/british-columbia/bc-coast-should-brace-for-monster-el-nino-year-uvic-professor/article26468934/

Published study can be found here: http://www.nature.com/ngeo/journal/vaop/ncurrent/full/ngeo2539.html

Check these links for more drought information:

WDFW 2015 Drought Updates: http://wdfw.wa.gov/conservation/drought/updates.html

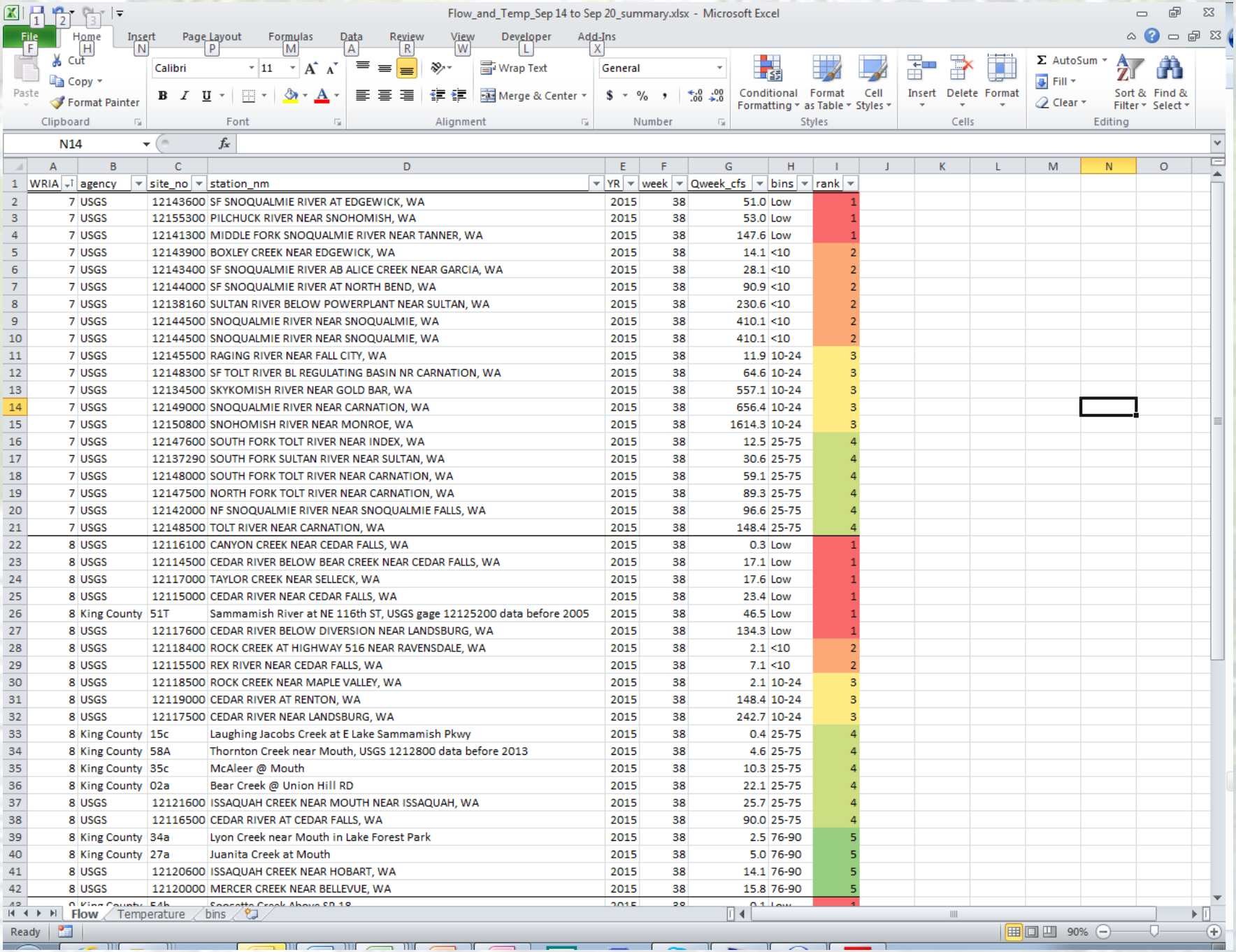
State Climatologist's Drought Reports: http://www.climate.washington.edu/events/2015drought/

El Niño Southern Oscillation (ENSO) Resources: http://iri.columbia.edu/our-expertise/climate/enso/

WATER SUPPLY STATUS

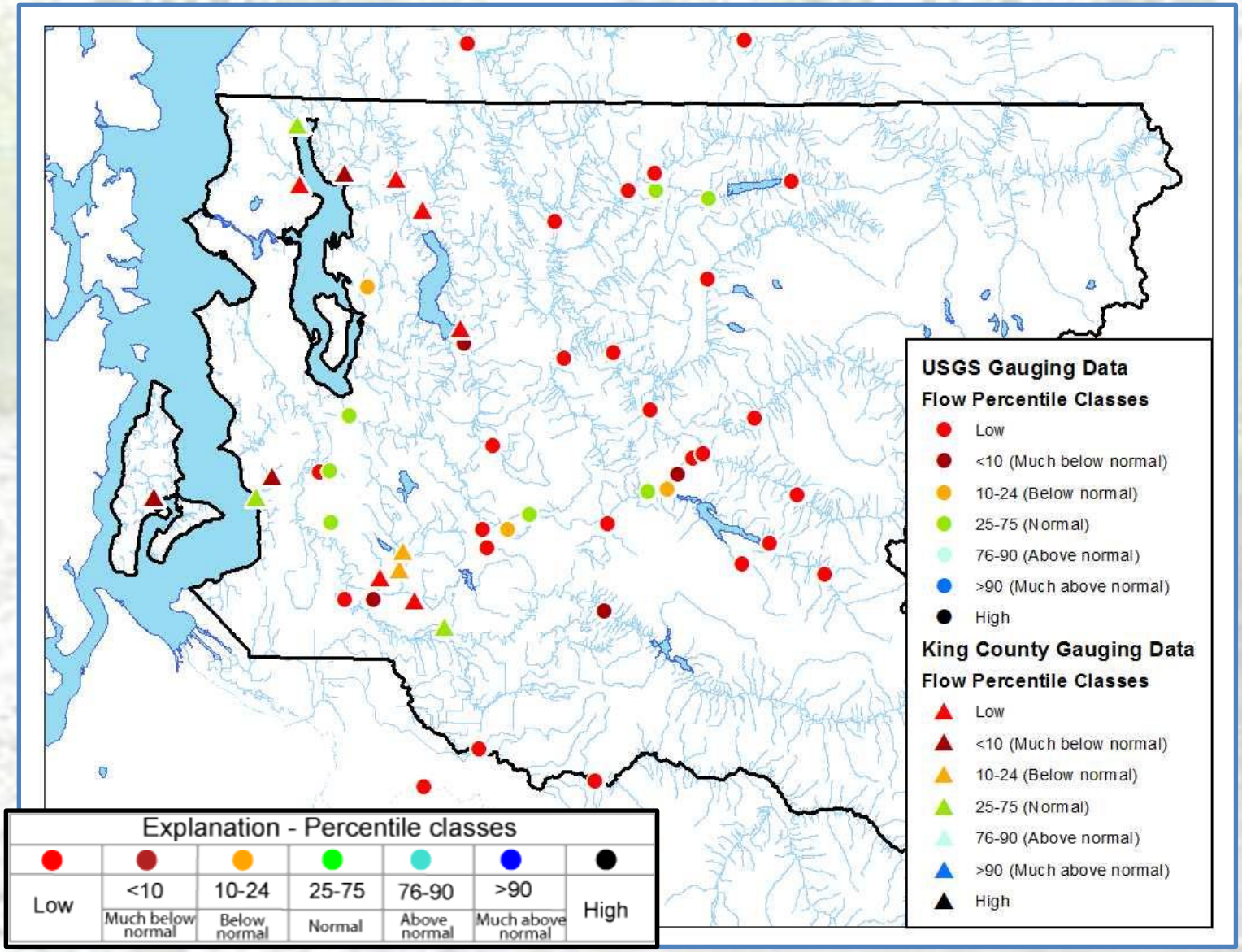
- The second stage water shortage response plan (voluntary reduction) initiated on August 11 by Seattle, Everett, Tacoma, and the Cascade Water Alliance remains in effect. Customers have been asked to continue to help by voluntarily reducing water use by 10 percent. More information available here: http://www.seattle.gov/util/MyServices/Water/AbouttheWaterSystem/WaterSupply/index.htm and here http://www.savingwater.org/.
- As of September 14, Seattle Public Utilities (SPU) reports that the combined reservoir storage of Chester Morse Lake, Masonry Pool, Lake Youngs and South Fork Tolt Reservoir remains below the long term average for this time of the year. See summary graphs from SPU below.
- Cascade Water Alliance has been maintaining the agreed-upon recreational level for Lake Tapps (http://cascadewater.org/news/lake-tapps-news/ for more information). The lake is now within the agreed-upon recreation level and will likely remain so into October. However, minimum instream flows in the White River below the diversion to Lake Tapps were not generally met last week (see

See more about: DeGasperi, Curtis.

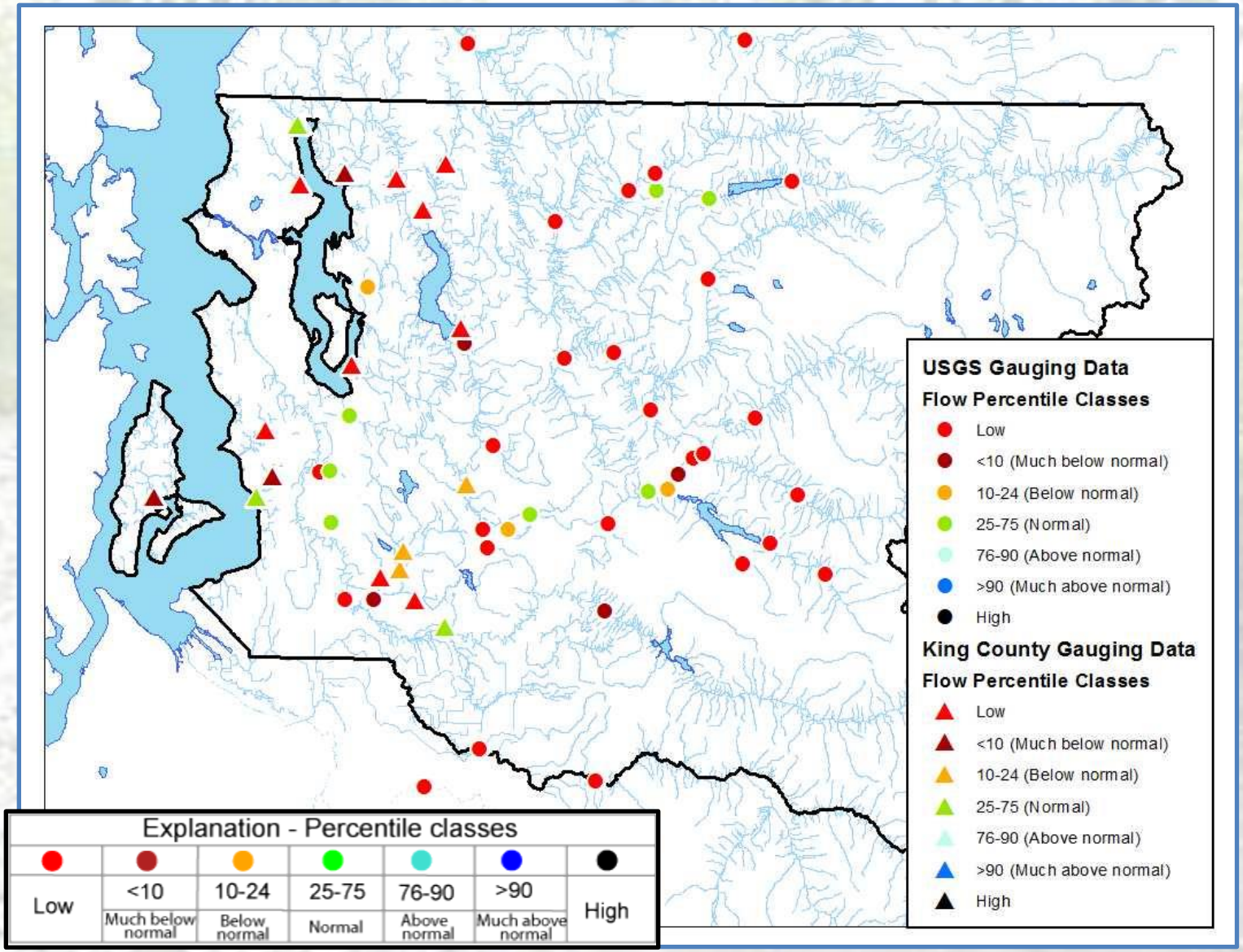


	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	WRIA	agency	site_no	station_nm	YR	week	Qweek_cfs	bins	rank						
2	7	USGS	12143600	SF SNOQUALMIE RIVER AT EDGEWICK, WA	2015	38	51.0	Low	1						
3	7	USGS	12155300	PILCHUCK RIVER NEAR SNOHOMISH, WA	2015	38	53.0	Low	1						
4	7	USGS	12141300	MIDDLE FORK SNOQUALMIE RIVER NEAR TANNER, WA	2015	38	147.6	Low	1						
5	7	USGS	12143900	BOXLEY CREEK NEAR EDGEWICK, WA	2015	38	14.1	<10	2						
6	7	USGS	12143400	SF SNOQUALMIE RIVER AB ALICE CREEK NEAR GARCIA, WA	2015	38	28.1	<10	2						
7	7	USGS	12144000	SF SNOQUALMIE RIVER AT NORTH BEND, WA	2015	38	90.9	<10	2						
8	7	USGS	12138160	SULTAN RIVER BELOW POWERPLANT NEAR SULTAN, WA	2015	38	230.6	<10	2						
9	7	USGS	12144500	SNOQUALMIE RIVER NEAR SNOQUALMIE, WA	2015	38	410.1	<10	2						
10	7	USGS	12144500	SNOQUALMIE RIVER NEAR SNOQUALMIE, WA	2015	38	410.1	<10	2						
11	7	USGS	12145500	RAGING RIVER NEAR FALL CITY, WA	2015	38	11.9	10-24	3						
12	7	USGS	12148300	SF TOLT RIVER BL REGULATING BASIN NR CARNATION, WA	2015	38	64.6	10-24	3						
13	7	USGS	12134500	SKYKOMISH RIVER NEAR GOLD BAR, WA	2015	38	557.1	10-24	3						
14	7	USGS	12149000	SNOQUALMIE RIVER NEAR CARNATION, WA	2015	38	656.4	10-24	3						
15	7	USGS	12150800	SNOHOMISH RIVER NEAR MONROE, WA	2015	38	1614.3	10-24	3						
16	7	USGS	12147600	SOUTH FORK TOLT RIVER NEAR INDEX, WA	2015	38	12.5	25-75	4						
17	7	USGS	12137290	SOUTH FORK SULTAN RIVER NEAR SULTAN, WA	2015	38	30.6	25-75	4						
18	7	USGS	12148000	SOUTH FORK TOLT RIVER NEAR CARNATION, WA	2015	38	59.1	25-75	4						
19	7	USGS	12147500	NORTH FORK TOLT RIVER NEAR CARNATION, WA	2015	38	89.3	25-75	4						
20	7	USGS	12142000	NF SNOQUALMIE RIVER NEAR SNOQUALMIE FALLS, WA	2015	38	96.6	25-75	4						
21	7	USGS	12148500	TOLT RIVER NEAR CARNATION, WA	2015	38	148.4	25-75	4						
22	8	USGS	12116100	CANYON CREEK NEAR CEDAR FALLS, WA	2015	38	0.3	Low	1						
23	8	USGS	12114500	CEDAR RIVER BELOW BEAR CREEK NEAR CEDAR FALLS, WA	2015	38	17.1	Low	1						
24	8	USGS	12117000	TAYLOR CREEK NEAR SELLECK, WA	2015	38	17.6	Low	1						
25	8	USGS	12115000	CEDAR RIVER NEAR CEDAR FALLS, WA	2015	38	23.4	Low	1						
26	8	King County	51T	Sammamish River at NE 116th ST, USGS gage 12125200 data before 2005	2015	38	46.5	Low	1						
27	8	USGS	12117600	CEDAR RIVER BELOW DIVERSION NEAR LANDSBURG, WA	2015	38	134.3	Low	1						
28	8	USGS	12118400	ROCK CREEK AT HIGHWAY 516 NEAR RAVENSDALE, WA	2015	38	2.1	<10	2						
29	8	USGS	12115500	REX RIVER NEAR CEDAR FALLS, WA	2015	38	7.1	<10	2						
30	8	USGS	12118500	ROCK CREEK NEAR MAPLE VALLEY, WA	2015	38	2.1	10-24	3						
31	8	USGS	12119000	CEDAR RIVER AT RENTON, WA	2015	38	148.4	10-24	3						
32	8	USGS	12117500	CEDAR RIVER NEAR LANDSBURG, WA	2015	38	242.7	10-24	3						
33	8	King County	15c	Laughing Jacobs Creek at E Lake Sammamish Pkwy	2015	38	0.4	25-75	4						
34	8	King County	58A	Thornton Creek near Mouth, USGS 1212800 data before 2013	2015	38	4.6	25-75	4						
35	8	King County	35c	McAleer @ Mouth	2015	38	10.3	25-75	4						
36	8	King County	02a	Bear Creek @ Union Hill RD	2015	38	22.1	25-75	4						
37	8	USGS	12121600	ISSAQUAH CREEK NEAR MOUTH NEAR ISSAQUAH, WA	2015	38	25.7	25-75	4						
38	8	USGS	12116500	CEDAR RIVER AT CEDAR FALLS, WA	2015	38	90.0	25-75	4						
39	8	King County	34a	Lyon Creek near Mouth in Lake Forest Park	2015	38	2.5	76-90	5						
40	8	King County	27a	Juanita Creek at Mouth	2015	38	5.0	76-90	5						
41	8	USGS	12120600	ISSAQUAH CREEK NEAR HOBART, WA	2015	38	14.1	76-90	5						
42	8	USGS	12120000	MERCER CREEK NEAR BELLEVUE, WA	2015	38	15.8	76-90	5						

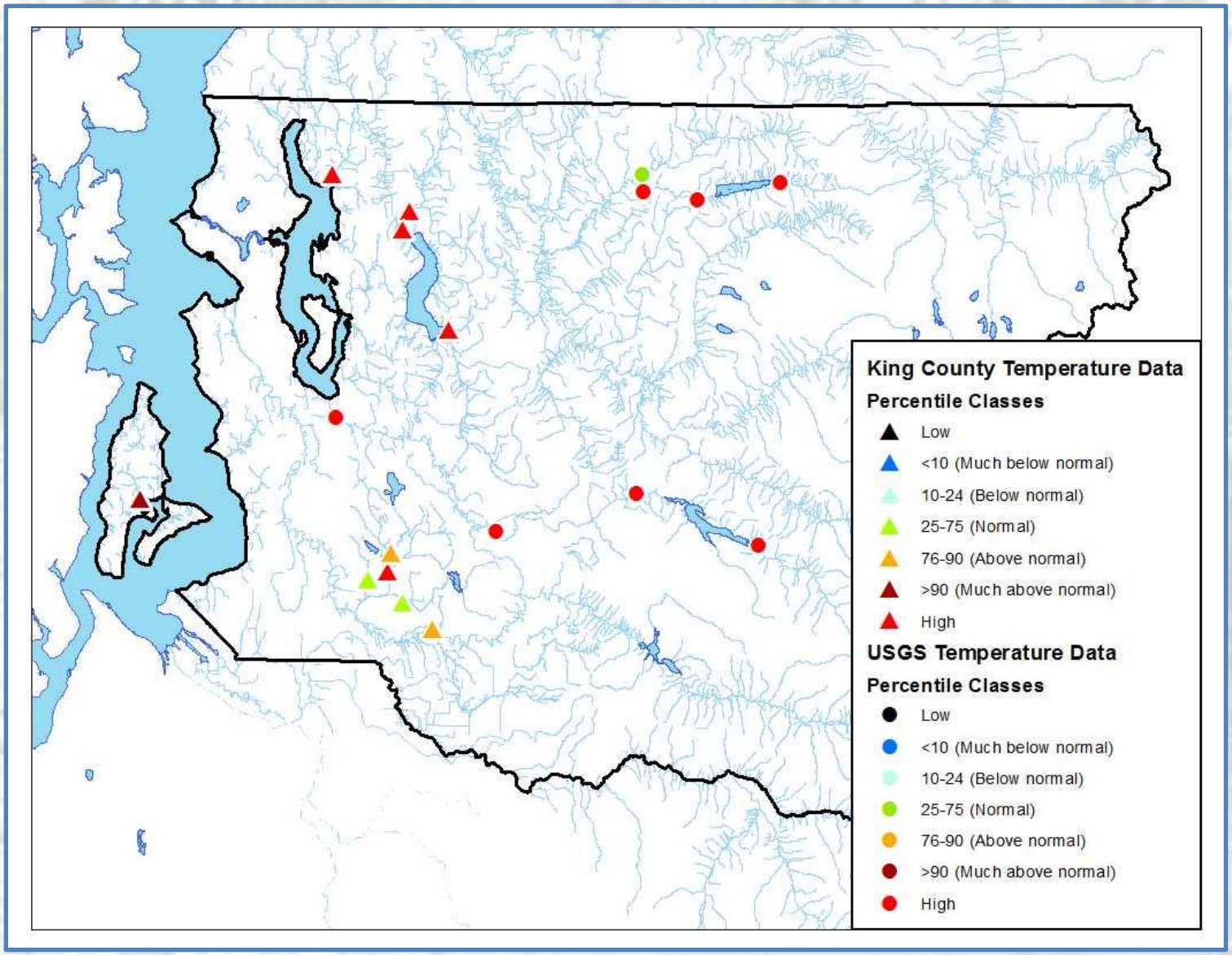
Week ending Sunday July 12th



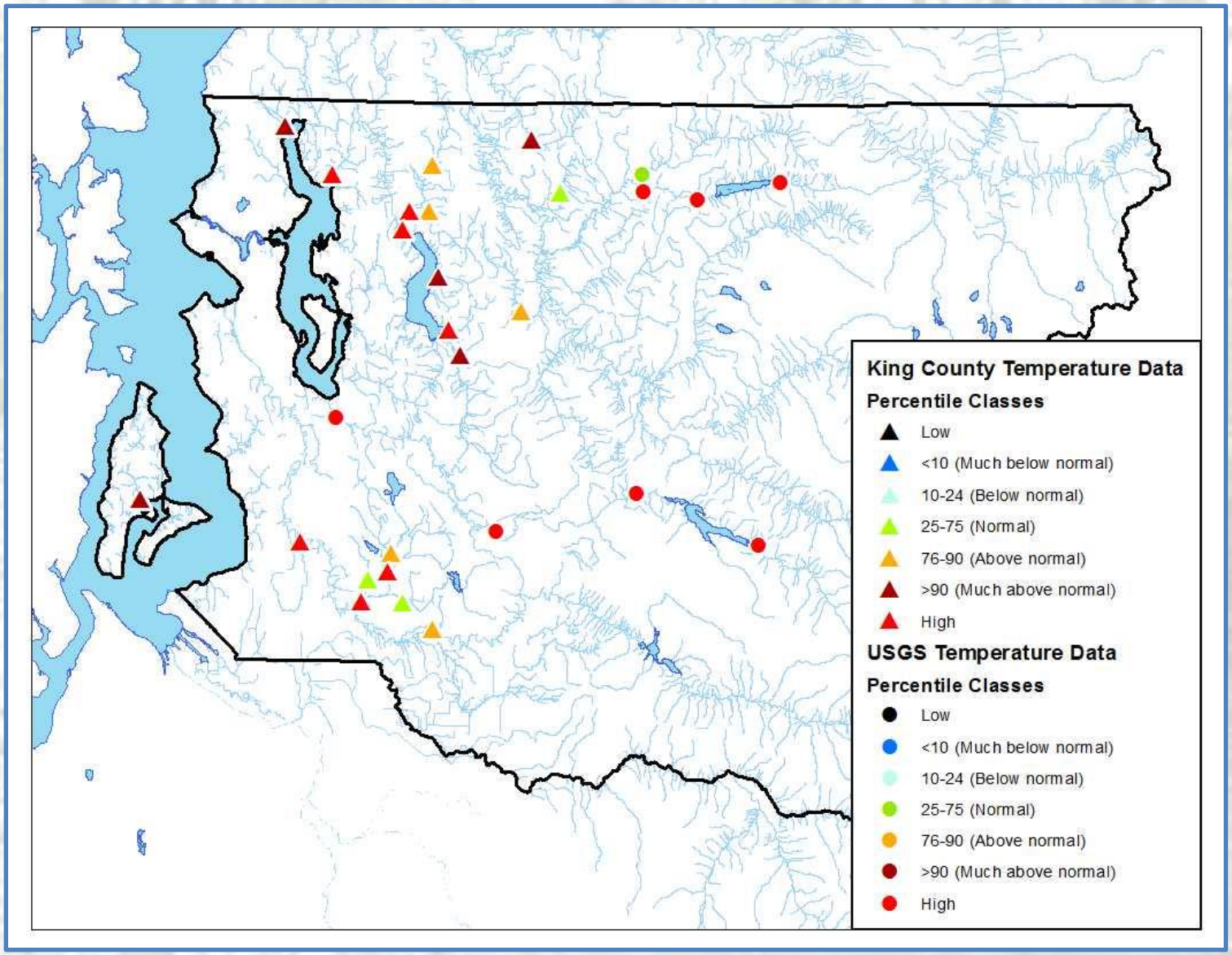
Week ending Sunday July 12th



Week ending Sunday July 12th



Week ending Sunday July 12th



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Low 2015 Snowpack and River Flows Studied to Provide Insight Into Future Droughts

Released: 9/8/2015 12:00:00 PM

Contact Information:
U.S. Department of the Interior, U.S. Geological Survey
Office of Communications and Publishing
12201 Sunrise Valley Dr, MS 119
Reston, VA 20192

Chris Konrad
Phone: 253-552-1634

Ryan McClymont
Phone: 503-583-7944

A hydrologic technician from the USGS Idaho Water Science Center measures streamflow in Fall Creek near Anderson Ranch Dam in southwestern Idaho. The USGS is collecting data at hundreds of sites on rivers and streams in six western states to document the 2015 drought. USGS scientists will analyze the data to identify which rivers and streams may be most vulnerable to future droughts. (High resolution image)

SEATTLE – U.S. Geological Survey hydrologic technicians are
measurements from hundreds of streams and rivers across th
States as part of a low flow study.

Spring snowpack in the western United States was extremely
compared to long-term averages. Warmer winter temperatur
precipitation fell more often as rain than snow and some plac
than-normal precipitation.

In August and September, USGS hydrologic technicians will m
and water temperature in hundreds of rivers and streams in
Nevada, Oregon, Utah and Washington to document the seve
drought.

"This year's warmer, drier weather provides a preview of how
may impact water resources in the study area," said Chris Ko
hydrologist and study project chief. "The goal is to provide inf
resource managers to help understand differences in how stre
drought and plan for future drought impacts throughout the r

With less spring and summer snowmelt at higher elevations,
and streams reached their peak flows earlier than normal and
historically low flows. These conditions create stresses on don
agricultural water supplies, fish and wildlife, and forests and

"This is a large scale study including six states, nearly 500 str
and dozens of technicians," said Rich Ferrero, USGS Northwes

"The streamflow data will be important for future drought planning and resource management decisi
western United States."

Hydrologic technicians from USGS water science centers are measuring streamflow and USGS scient
compare those data with measurements from previous years to answer several water-management
including:

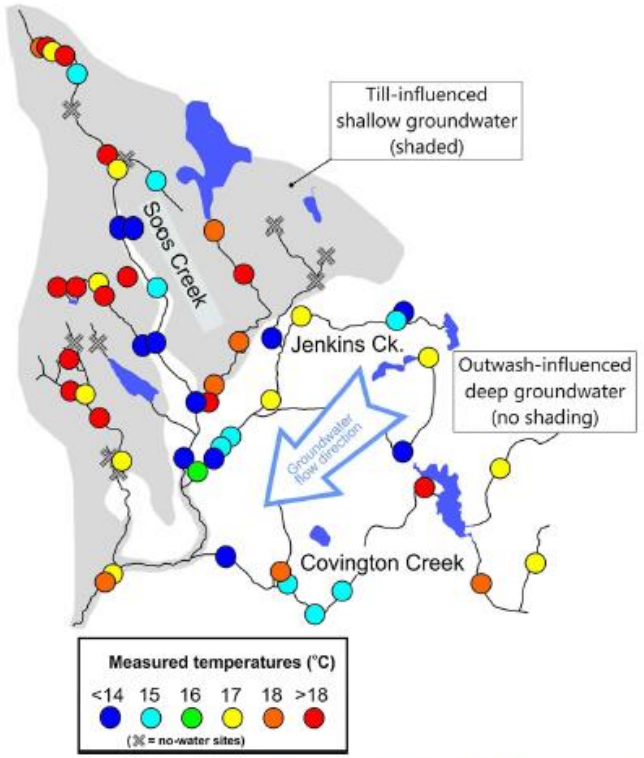
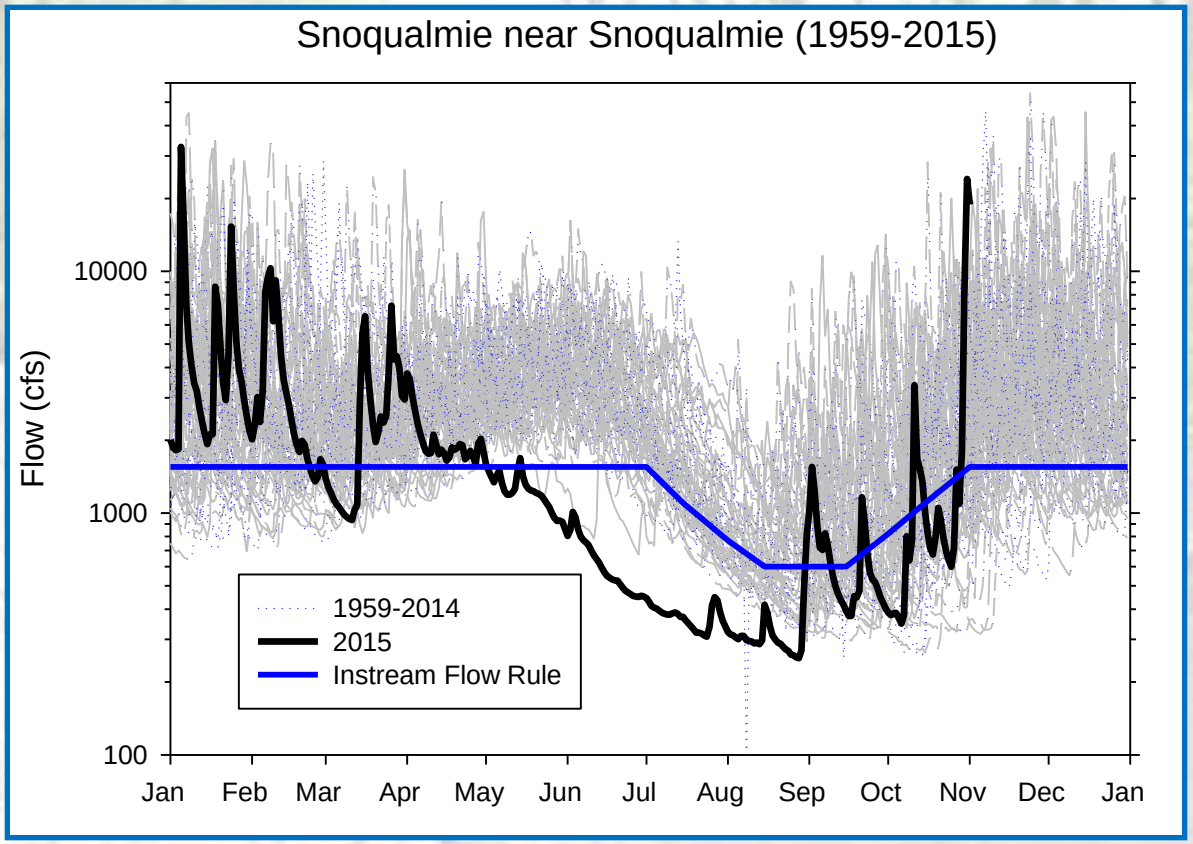


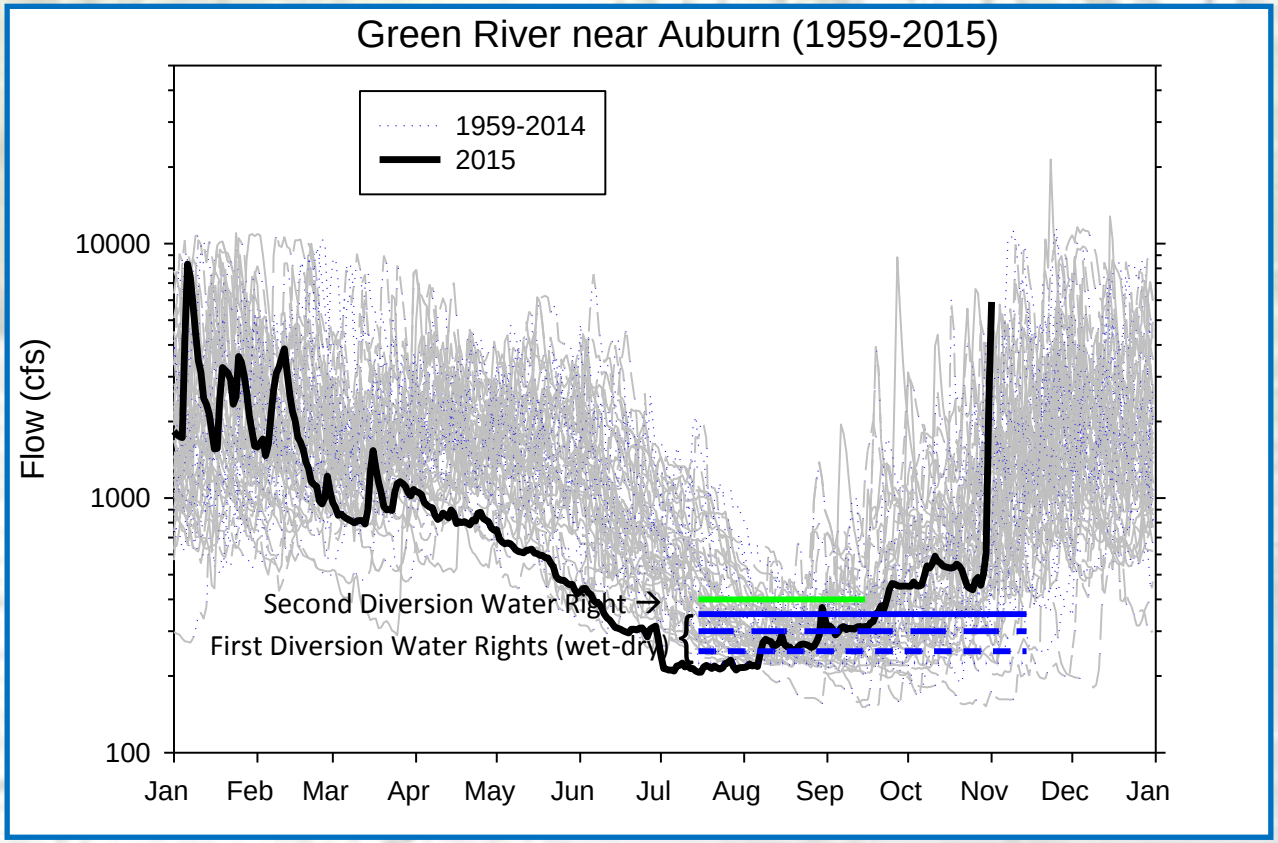
Figure 7. Stream temperatures in the Soos Creek basin (1999 data), displayed spatially with respect to dominant geologic deposits and inferred groundwater flow. Shallow subsurface flow perched over glacial till (shaded region) correlates with relatively warm temperatures (typically 17°C or more) or dry channels; to the southeast, deep groundwater flow through glacial outwash sands and gravels correlates with a marked ~3°C cooling of water, particularly in the lower main stem channels of Covington and Jenkins creeks. Cool temperatures are also found in the main channel of Soos Creek, which flows through a broad, outwash-filled valley

Booth et al. 2014. Hydrological Processes.

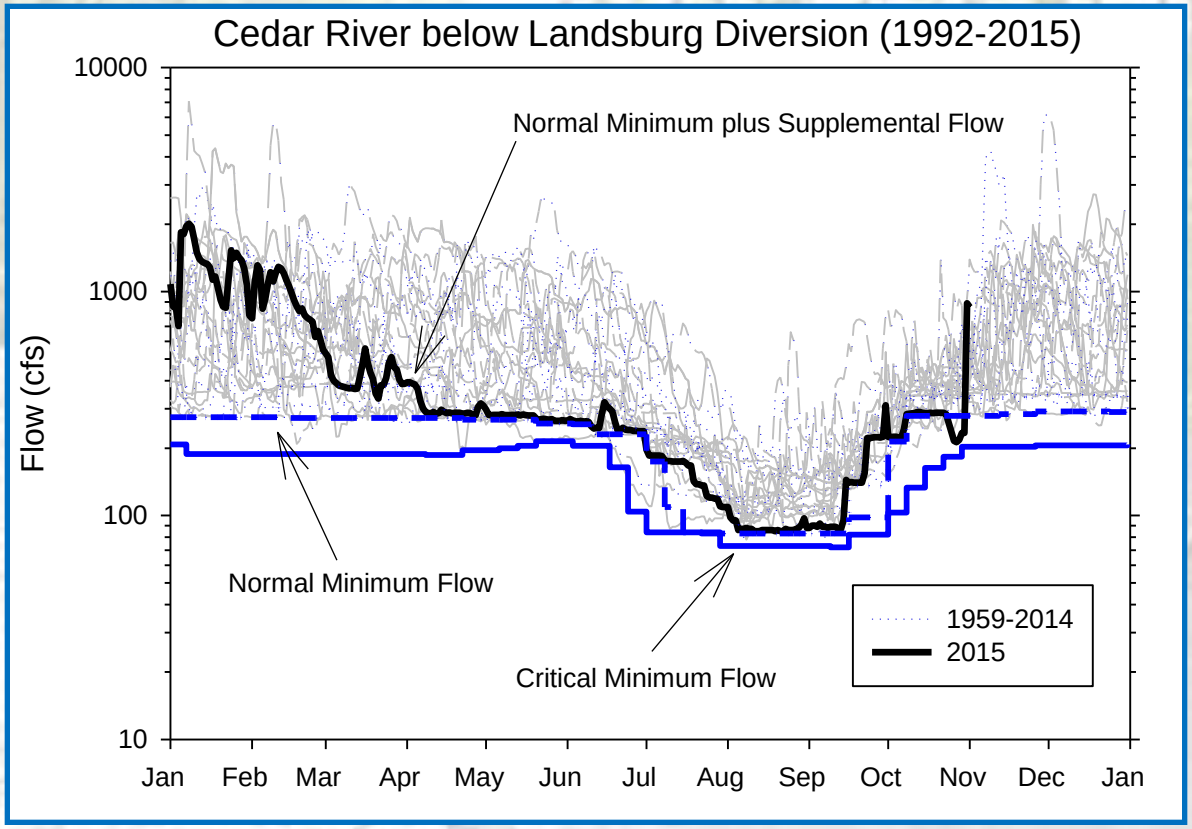
Snoqualmie Near Snoqualmie



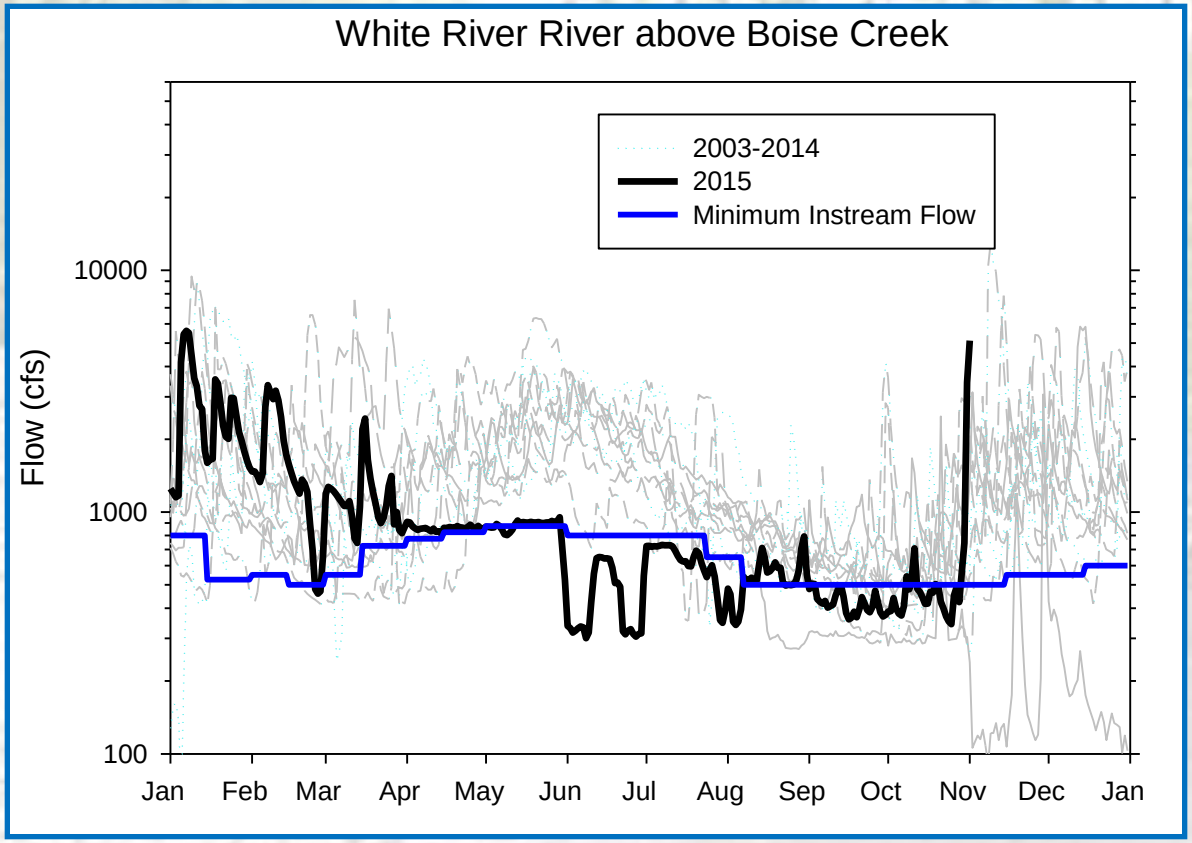
Green River Near Auburn



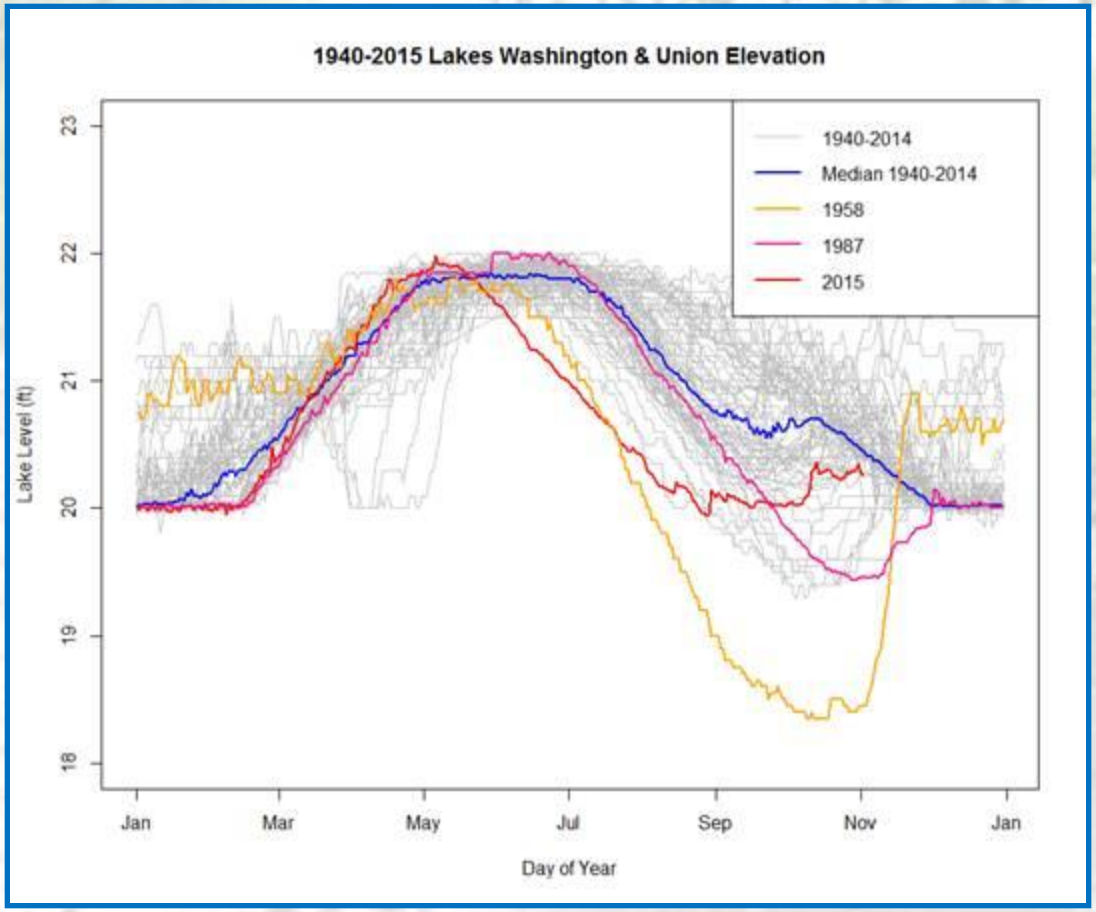
Cedar River below Landsburg



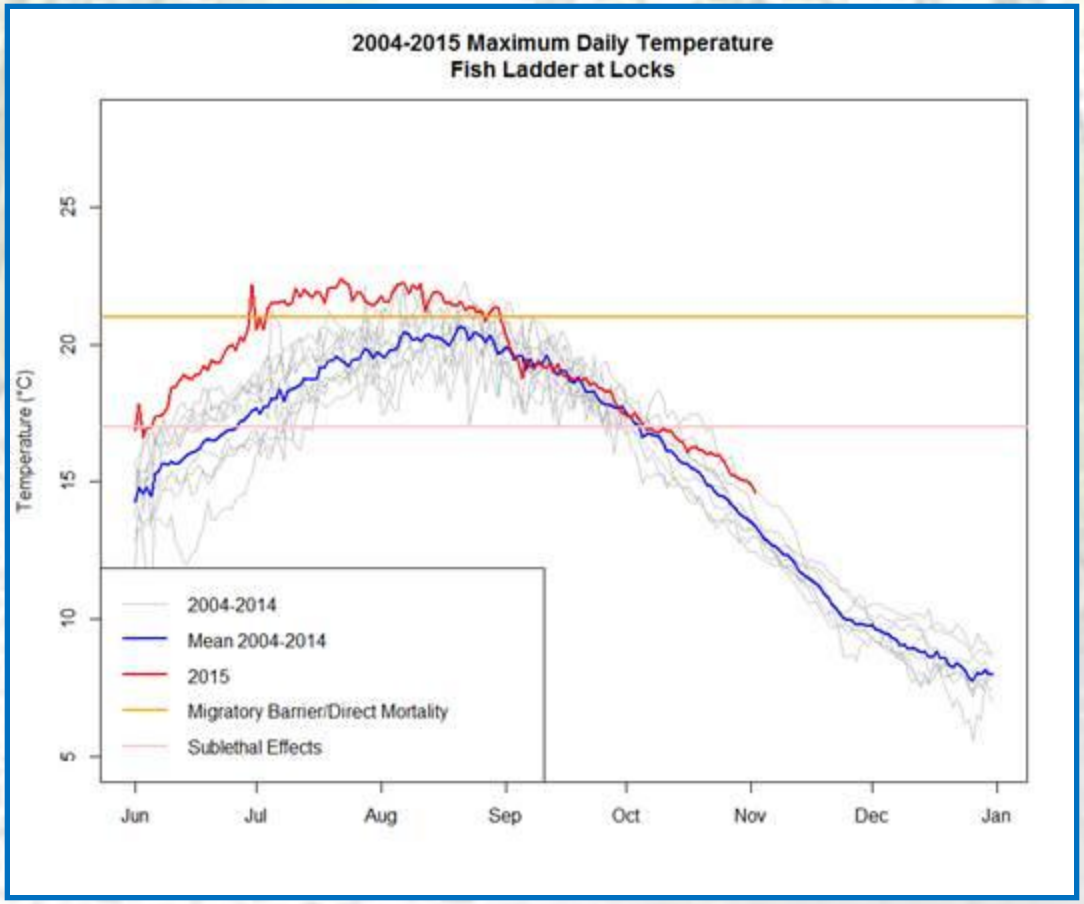
White River Above Boise Creek



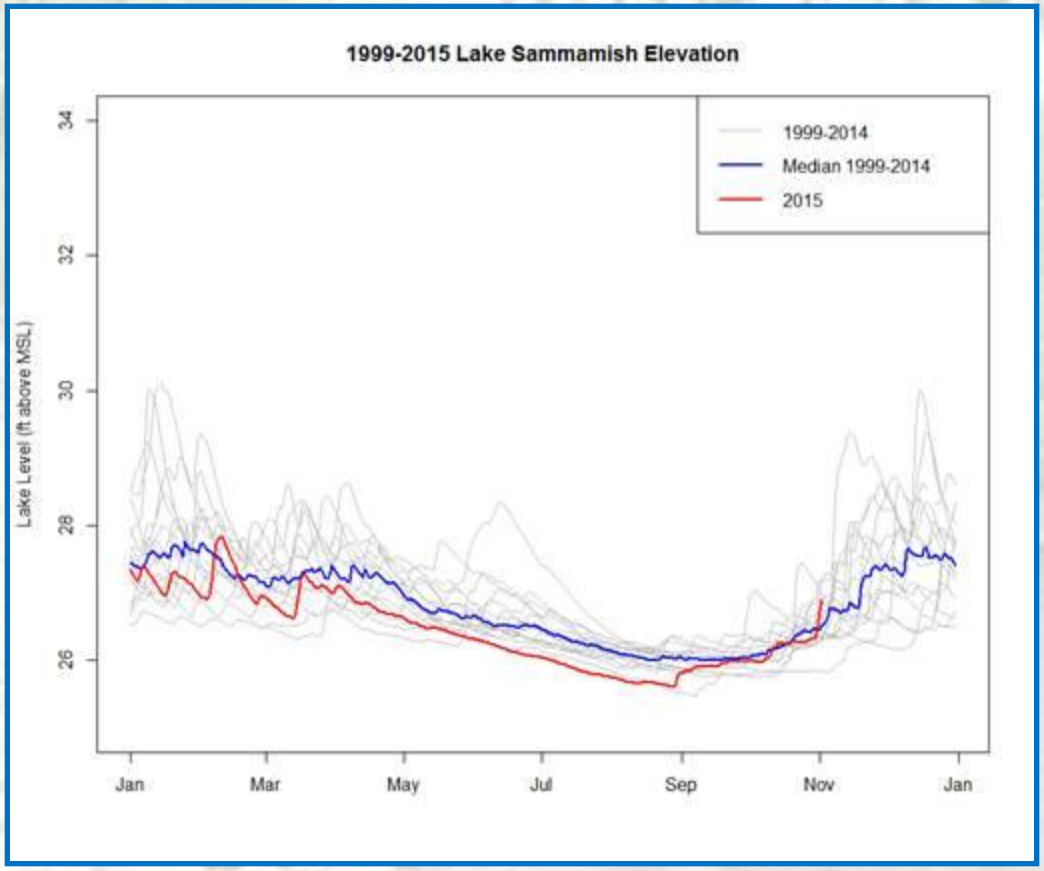
Lake Washington/Lake Union



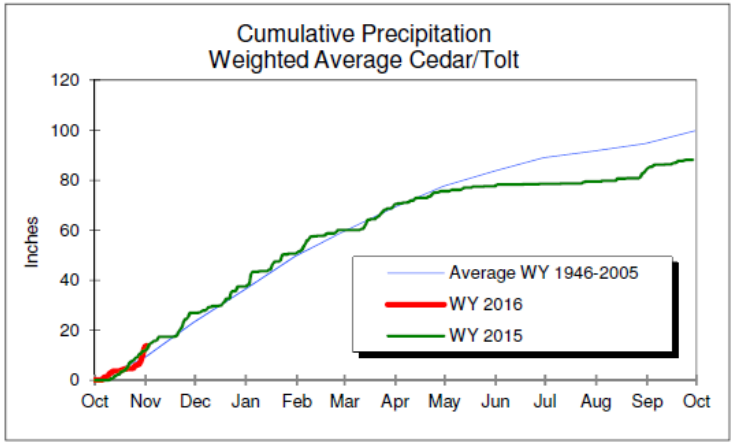
Ballard Locks Fish Ladder



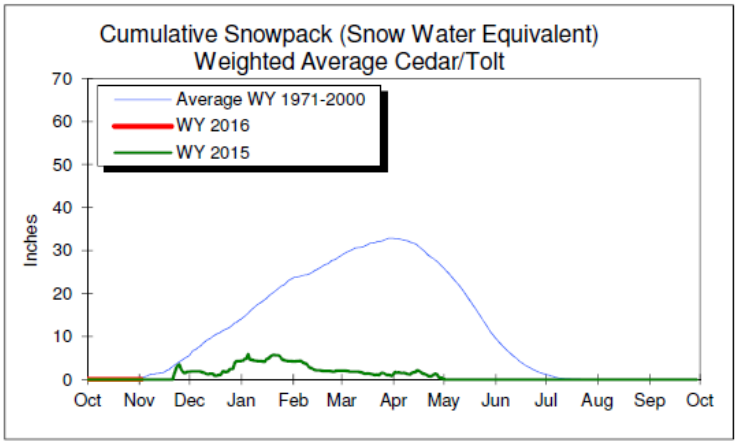
Lake Sammamish



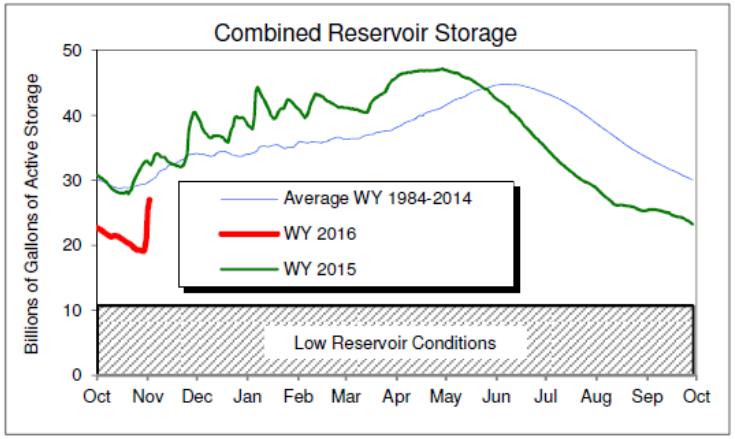
Seattle Public Utilities Water System Synopsis as of November 2, 2015



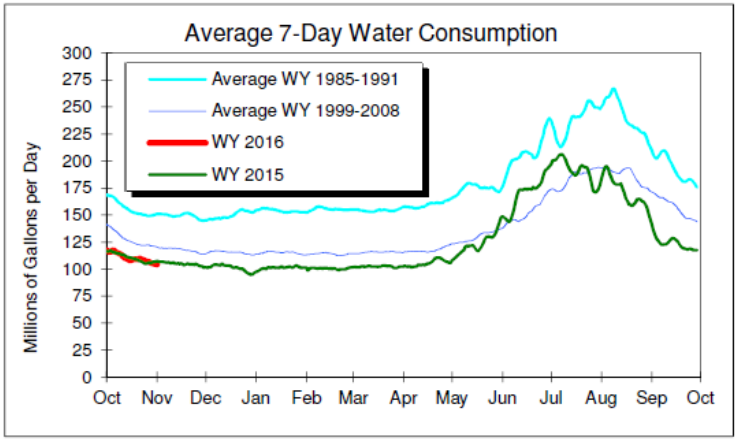
Precipitation was recorded in the Cedar River and South Fork Tolt River Watersheds over the past week.



The average snow accumulation across the sites that we monitor is estimated to be about 0.0 inches snow water equivalent which is at the long term average for this time of the year.



The combined reservoir storage of Chester Morse Lake, Masonry Pool, Lake Youngs and South Fork Tolt Reservoir is below the long term average for this time of the year.

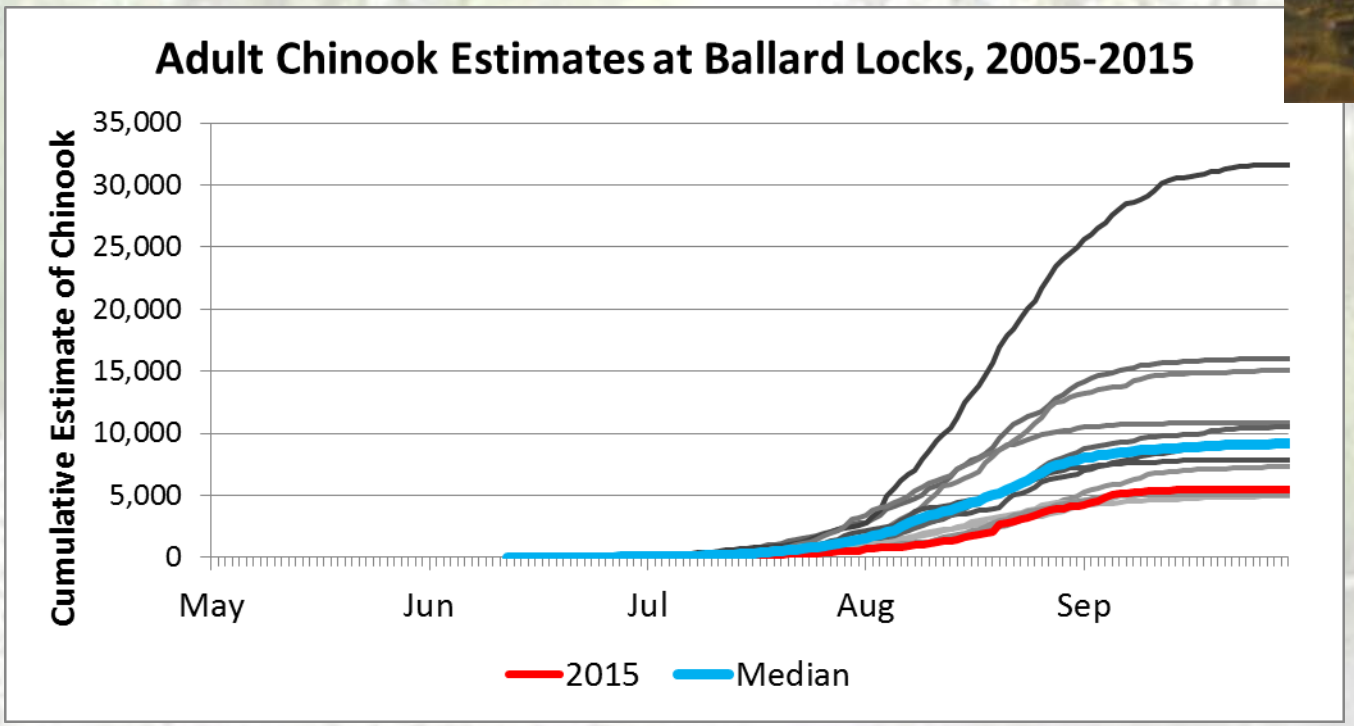


Water use over the past week averaged about 104 million gallons per day (mgd), which is less than the 120 mgd used during the same period over the years 1999-2008.

All data is provisional and subject to revision.

Thoughts…

Methow Valley News

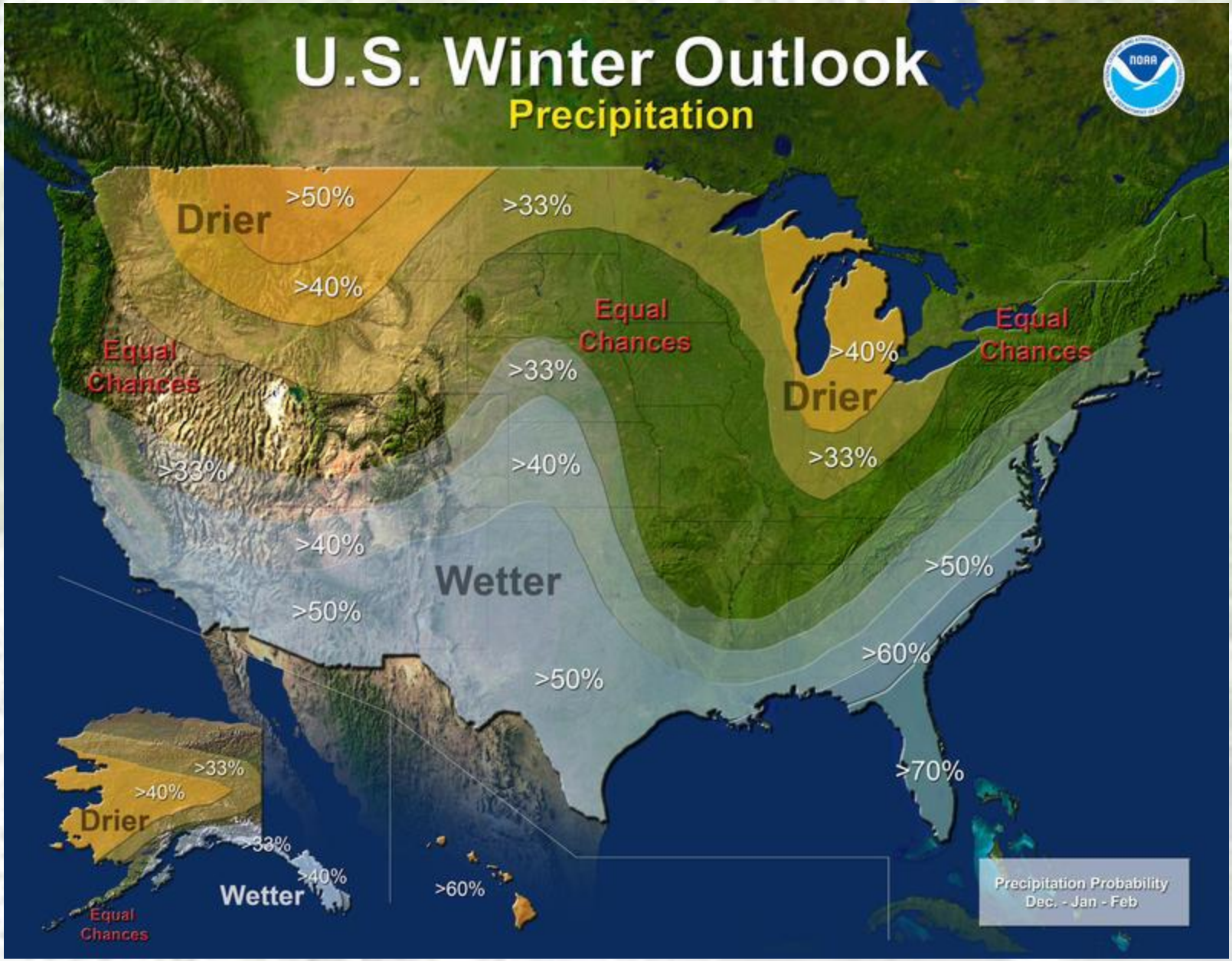


- What were (or will be) the biological consequences?

QUESTIONS?

"You never miss your water till the well runs dry"

Curtis DeGasperi
King County Water and Land Resources
(206) 684-1268
curtis.degasperi@kingcounty.gov



http://kuow.org/post/more-washington-drought-ahead-noaa-outlook-points-way